

REMARKS

The foregoing amendment cancels claims 1-6 and 13-19 and amends independent claim 7. Pending in the application are claims 7-12, of which claim 7 is independent. The following remarks address all stated grounds for rejection and place the presently pending claims, as identified above, in condition for allowance.

Claim 7 is amended to include the subject matter of canceled claim 19 and to further specify how the protective membrane-equipped composite electrolyte is produced. Specifically, claim 7 is amended to clarify that the protective membrane-equipped composite electrolyte is formed by first impregnating a matrix with a liquid electrolyte, then coating the entire surface of the matrix with a crosslinked polymer membrane. The claim also specifies that the crosslinked polymer membrane is formed by a chemical reaction between a crosslinkable polymer deposited onto the entire surface of the matrix and a crosslinking agent. Support for the amendment can be found at least, for example, on page 10, lines 15-22 and from page 21, line 4 through page 24, line 4, as well as in Figure 3. *No new matter is added.*

Amendment and/or cancellation of the claims is not to be construed as an acquiescence to any of the objections/rejections set forth in the instant Office Action, and were done solely to expedite prosecution of the application. Applicant reserves the right to pursue the claims as originally filed, or similar claims, in this or one or more subsequent patent applications.

35 U.S.C. 112 Rejection

Regarding the rejection of claim 19 under 35 U.S.C. 112, second paragraph, Applicant has canceled claim 19, thus obviating the Examiner's objection. Amended claim 7, which includes the subject matter recited in canceled claim 19, provides antecedent basis for a "gas diffusion layer" in line 7.

35 U.S.C. 103 Rejections

Applicant traverses the rejection of the claims under 35 U.S.C. 103(a) over Suzuki (U.S. Patent No. 5,346,780) in view of Savinell *et al.* (U.S. Patent No. 5,525,436) and submit that the presently pending claims are patentable over the cited references. The cited references, alone or in combination, do not teach or suggest a fuel cell including the claimed protective membrane-equipped composite electrolyte. Specifically, the references fail to teach or suggest a protective membrane-equipped composite electrolyte that is formed by initially impregnating a matrix with a liquid electrolyte, followed by coating the entire surface of the matrix with a crosslinked polymer membrane, where the crosslinked polymer membrane is formed by a chemical reaction between a crosslinkable polymer deposited *onto* the entire surface of the matrix and a crosslinking agent, as recited in independent claim 7.

Claim 7 is intended to recite that the protective crosslinked polymer membrane is formed on the outer surface of the matrix, after the matrix is impregnated with a liquid electrolyte. To form the protective membrane, a crosslinkable polymer, separate from the matrix, is deposited onto the entire outer surface of the electrolyte-impregnated matrix, thereby coating the matrix. Then, the protective membrane is formed by reacting the crosslinkable polymer with a crosslinking agent to crosslink the crosslinkable polymer adhered to the surface of the electrolyte-impregnated matrix.

As recognized by the Examiner, the Suzuki reference, which describes a fuel cell including an electrolyte layer held by a pair of gas-diffusion layers, does not teach or suggest that the electrolyte layer can include a surface coated with a crosslinked polymer membrane, as recited in claim 7.

According to the Examiner, because the Savinell reference discloses that polymers acting as an electrolyte matrix can be cross-linked on the matrix surface, the claimed invention is obvious. Applicant respectfully disagrees. As recognized by the Examiner, the Savinell reference suggests that polymers which demonstrate solubility in dilute acid may be made more stable by cross-linking in place in the film by any one of a number of known cross-linking techniques, including free radical cross-linking (see column 5, lines 45 to 50).

However, Savinell *et al.* simply discloses a crosslinkable polymer, and does not disclose the claimed matrix impregnated with the liquid electrolyte having the claimed crosslinked polymer membrane formed on the entire surface of the matrix. According to the disclosure of Savinell *et al.*, films of polybenzimidazole were prepared, and the films were doped with H₂SO₄ or H₃PO₄ by acid sorption from aqueous solutions (see column 7, lines 45-54). Assuming that the method described in Savinell is applied to the films of crosslinkable polymer doped with liquid electrolyte, the crosslinked polymer is impregnated with liquid electrolyte *after* crosslinking of the polymer, so that the crosslinked polymer of Savinell *et al.* includes liquid electrolyte.

According to the disclosure of the specification, and as shown in Figure 3, a matrix is impregnated with liquid electrolyte. Then, the crosslinked polymer membrane produced in a chemical reaction between the crosslinking agent and the crosslinkable polymer deposited onto the entire surface of the matrix. Therefore, the protective membrane-equipped composite electrolyte according to the present invention does not include any liquid electrolyte in the crosslinked polymer membrane.

In contrast to the Savinell reference, amended claim 7 recites that a matrix impregnated with a liquid electrolyte is produced *initially*, i.e., before application of a crosslinked polymer membrane. *Then*, the crosslinking agent and the crosslinkable polymer are deposited onto the entire surface of the matrix (see page 22, lines 4 to 7, page 23, lines 7 to 9). Namely, the polymer membrane produced by the reaction between the crosslinkable polymer and crosslinking agent is deposited on the entire surface of the matrix *after* the matrix has been impregnated with a liquid electrolyte.

Savinell *et al.* does not disclose a crosslinked polymer membrane produced in a chemical reaction between a crosslinkable polymer, which has been deposited *onto* the *entire* surface of an electrolyte-impregnated-matrix, and a crosslinking agent. Rather, Savinell merely discloses that polymers may be crosslinked prior to impregnating the polymers with an acid. The Savinell *et al.*, also only discloses *partial* crosslinking in the film. In this respect, the present invention is different from the technique of Savinell *et al.*

The protective membrane-equipped composite electrolyte recited in independent claim 7 is greatly different from the electrolyte disclosed by Savinell et al.

The disclosures of Suzuki (US Patent 5,346,780) and WO 00/44816 do not compensate for the deficiencies of the Savinell et al reference. Therefore, the subject matter of claim 7 distinguishes patentably over the cited references.

Furthermore, motivation to combine the references is lacking. According to the Examiner, because both references are directed to proton conducting polymers used as membranes in fuel cells, the combination of the references is proper. However, the Examiner has still not identified motivation in either of the references for making a change to its own teachings to arrive at the invention under rejection. Therefore, Applicant maintains that the instant rejection constitutes nothing more than a picking and choosing of the various elements of the claims from a number of references based, not on motivation from the references themselves, but rather based on the teachings of the application. Thus, the instant rejection constitutes an impermissible hindsight reconstruction of the invention.

For the above reasons, the amended claim 7 distinguishes patentably over the cited references. Dependent claims 8 to 12 are dependant from directly or indirectly from claim 7. Therefore, these claims should also be allowable.


CONCLUSION

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue. If, however, the Examiner considers that obstacles to allowance of these claims persist, we invite a telephone call to Applicant's representative at the telephone number listed below.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 12-0080, under Order No. CSC-029 from which the undersigned is authorized to draw.

Dated: February 18, 2004

Respectfully submitted,

By 
Anthony A. Laurentano
Registration No.: 38,220
LAHIVE & COCKFIELD, LLP
28 State Street
Boston, Massachusetts 02109
(617) 227-7400
(617) 742-4214 (Fax)
Attorney for Applicant